



**Module-4**

- 7 a. Employ Taylor Series Method to obtain an approximate value of  $y$  at  $x = 0.2$  for the differential equation  $\frac{dy}{dx} = -xy$ . Given  $y(0) = 1$ . (06 Marks)
- b. Using Modified Euler's method, find  $y(0.1)$  correct to four decimal places, solving the equation  $\frac{dy}{dx} = x - y^2$ ,  $y(0) = 1$  taking  $h = 0.1$  carry out two modification. (07 Marks)
- c. Given  $\frac{dy}{dx} = x^2(1+y)$ , and  $y(1) = 1$ ,  $y(1.1) = 1.233$ ,  $y(1.2) = 1.5848$ ,  $y(1.3) = 1.979$ , evaluate  $y(1.4)$  by Milne's Predictor-Corrector method. Use Corrector formula twice. (07 Marks)

OR

- 8 a. Using modified Euler's method, find  $y(20.2)$ , given that  $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$  with  $y(20) = 5$  taking  $h = 0.2$  (06 Marks)
- b. Using Runge-Kutta method of fourth order solve for  $y(0.1)$  given that  $y' = xy + y^2$ ,  $y(0) = 1$ . (07 Marks)
- c. Apply Adam's - Bashforth method to solve the equation  $(y^2 + 1)dy - x^2 dx = 0$  at  $x = 1$  given  $y(0) = 1$ ,  $y(0.25) = 1.0026$ ,  $y(0.5) = 1.0206$ ,  $y(0.75) = 1.0679$ . (07 Marks)

**Module-5**

- 9 a. Use Runge-Kutta method to find  $y(0.2)$  for the equation  $\frac{d^2y}{dx^2} = x \frac{dy}{dx} - y$  with  $y(1) = 1$ ,  $y'(1) = 0$ . (07 Marks)
- b. Derive Euler's Equation in the standard form  $\frac{\partial t}{\partial y} - \frac{d}{dx} \left( \frac{\partial t}{\partial y} \right) = 0$  (07 Marks)
- c. Prove that the Geodesics of a two points in a plane is straight line joining them. (06 Marks)

OR

- 10 a. Apply Milne's method to solve  $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ . Given the following table of initial values.

Compute  $y(0.4)$ .

x	0	0.1	0.2	0.3
y	1	1.1103	1.2427	1.399
y'	1	1.2103	1.4427	1.699

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(07 Marks)

- b. Find the extremal of the functional  $\int_0^4 [x y' - (y')^2] dx$  which is determined by the boundary conditions  $y(0) = 0$  and  $y(4) = 3$ . (06 Marks)
- c. A cable hangs freely under gravity from the fixed points. Show that the shape of the curve is Catenary. (07 Marks)